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ACCELERATOR DIVISION SATELLITE REFRIGERATOR COMPRESSOR SYSTEM AND GAS PURIFICATION PROCEDURES

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September 8, 1983

INTRODUCTION

Following construction and prior to commissioning a compressor system it is necessary to test the piping, fill the purification vessels with absorbents and remove all contaminates. The following technical papers were written to complete those tasks.

Compressor System Procedures

1. Mycom Compressor Ø Building Pressure Test Procedure
2. Mycom Compressor Switchyard Building Pressure Test Procedure
3. Mycom Compressor BØ Building Pressure Test Procedure
4. Satellite Compressor System Procedures for Major Leak Repairs
5. Satellite Compressor System (Procedures for Changing the Compressor Motor)
6. Satellite Compressor System (Procedure for Changing the Pilot Operated Safety Relief Valve)

Gas Purification Procedures

1. Dehydration Procedure of Mycom Compressor
2. Molecular Sieve Installation (inital)
3. Molecular Sieve Change
4. Charcoal Pellet Installation and Dehydration
5. Final Pump and Helium Purge for Mycom Compressor System

Reference Drawing :

1. 9140-ME-129720

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MYCOM COMPRESSOR O BUILDING PRESSURE TEST PROCEDURE

Ref: Schematic Dwg. #9140-ME-120804-B

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IMPORTANT: Call control room and inform them when test shall occur.

The compressor systems consists of:

1. Mycom compressors designated number 1,2,3,4.
   a. Oil coolers
   b. Bulk oil knockouts

2. Oil removal elements
   a. No. 1 coalescer demister vessel mfg. by Monsanto
   b. No. 2 coalescer demister vessel mfg. by Monsanto
   c. No. 3 coalescer demister vessel mfg. by Monsanto
   d. Charcoal adsorber vessel mfg. by Howe Corp. or Electro-dryer Corp.
   e. Molecular sieve vessel mfg. by Howe Corp. or Electro-dryer Corp.
   f. Final filter vessel mfg. by Dollinger

3. Process piping
   a. Two and three-inch high pressure
   b. Four and eight-inch low pressure

Pressure vessels manufactured by outside firms have all been tested and are ASME code "U" stamped.

Only the process piping remains to be tested.

TEST SET UP PROCEDURE LOW AND HIGH PRESSURES

1. At ring service lines close and lock out (3) three-inch valves on high pressure system MV-099-H, MV-411-H, and MV-412-H.

   Also (3) eight-inch valves on low pressure system MV-401-H, MV-402-H and MV-001-H.

2. Provide gas helium tube trailer with high pressure regulator, hand valves MV-600-H, pressure gauges PI-601-H, relief valves SV-600-H.

3. Remove and blank off each compressor pilot operated relief valve SV-078-H. Install (1) SV-603-H relief valve at low pressure side. (This one relief protects all compressors low pressure piping.) Add MV-604-H. Also add SV-630-H on L.P. 4" header.

4. Install pressure gauge PI-005-H and manual valve MV-116-H at MV-001-H low pressure manifold and position outside building.

5. Remove SV-087-H relief valves located on each oil removal skid, and plug 3/4 N.P.T. line.

6. Add pressure gauge PI-055-H and manual valve MV-005-H to manual valve MV-089-H on oil skid final filter and position outside building connect a tube trailer line to point "A". This applies to all skids on system.

7. Add (1) pressure gauge P-112-H and (1) manual valve MV-112-H to manual valve MV-089-H on 3-inch high pressure line and position outside building.

8. Disconnect SV-078-H pilot operated sensing line and plug.

Note: On each compressor do the following:

9. Close manual valve MV-006-H 4-inch compressor suction feed valve.

10. Close MV-013-H at compressor oil seal reservoir ACC-1.

11. Close MV-007-H at 14.7 PSIG compressor gauge.

12. Close MV-084-0. This valve is on #1 coalescer oil manifold return line.

13. Remove 2-inch check valve CV-080-H and blank off both sides.

14. Open (2) FI-098-H feed valves and (2) FI-097-H feed valves.

HIGH PRESSURE TESTING

The high pressure system shall be split into two sections. One section to encompass the compressor from the 4-inch suction valve (MV-006-H) to the 2-inch discharge check valve (CV-080-H). This part to be tested at 406 PSI. This test shall be referred to as the compressor high pressure system.

The second section continues from the 2-inch discharge check valve through all 3 coalescers, charcoal, molecular sieve, final filter tanks, up to the 3-inch manifold valves (MV-099-H). This part to be tested at 438 PSI and shall be referred to as the gas purification system.

TESTING COMPRESSOR HIGH PRESSURE SYSTEM

(MAXIMUM OPERATION 325 PSIG TEST 406 PSI)

1. On each compressor do the following:

   a. Close MV-013-H (compressor oil seal reservoir valves)
   b. Close MV-012-H (compressor low pressure gauge PI-012-H)
   c. Close MV-084-O (coalescer oil manifold return valve)
   d. Close MV-007-H (compressor suction PI-007-H)

2. Low pressure relief (7 PSI SV-003-H) to be in operating condition.

3. On helium feed trailer connect line to point "B" (connects 4 compressors together).

4. Position all other valves not mentioned in the normal operating position.

5. Have safety department inspect and approve test set up and equipment used.

6. All personnel must evacuate building.

7. Back off high pressure regulator.

8. Open one high pressure valve on helium tube trailer.

9. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

10. Open manual valves MV-604-H on each compressor.

11. When pressure gauge PI-601-H on trailer feed line, and pressure gauge PI-113-H reads 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note these gauges must read within a few pounds of each other.)

12. Hold pressure of 10 minutes.

13. Enter building, snoop all joints and welds for leaks; identify, mark and record any leaks.

14. Evacuate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 406 PSIG.

15. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum 10 minutes.

16. Add gas if required to compensate for initial temperature change. (Do not exceed 406 PSI.)

17. Reduce pressure to 300 PSI then repressurize to 406 PSIG, repeat 2 times.

18. If at the final pressure test of 406 PSIG, there are no pressure changes, the piping system will have passed the test.

19. Reduce system pressure to 300 PSIG.

20. Enter building, snoop all joints and welds for leaks; identify mark; and record any leaks.

21. Reduce pressure in total high pressure system to 1 PSI.

22. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

23. Disconnect feed line at point "B".

HIGH PRESSURE GAS PURIFICATION SYSTEM
(Maximum operation 350 PSI, Test 438 PSI)

1. Remove from normally closed EV-097-H kick back valve any electrical power or instrument air source.

2. Low pressure relief valve SV-003-H (7 PSI) must be in operating condition.

3. MV-089-H at final filter must be open.

4. MV-098-H at 3-inch, 3-valve manifold must be open.

5. Connect point "A" to tube trailer.

6. Close MV-099-H, MV-411-H, MV-412-H, on 3-inch feed line manifold on each compressor.

7. Close MV-084-0 1/2-inch oil return line from coalescer manifold on each compressor.

8. Back off high pressure regulator.

9. Open one high pressure valve on helium tube trailer.

10. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

11. When pressure gauge PI-601-H on trailer feed line, gauge PI-112-H and PI-114-H on high pressure manifold, and pressure gauges PI-055-H all read 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note all these gauges must read within a few pounds of each other.)

12. Hold pressure for 10 minutes.

13. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

14. Evacuate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 438 PSIG.

15. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum of 10 minutes.

16. Add gas if required to compensate for initial temperature change. (Do not exceed 438 PSI.)

17. Reduce pressure to 300 PSI then repressurize to 438 PSIG, repeat 2 times.

18. If at the final pressure test of 438 PSIG, there are no pressure changes, the piping system will have passed the test.

19. Reduce system pressure to 300 PSIG.

20. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

21. Reduce pressure in total high pressure system to 1 PSI outside the building.

22. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

LOW PRESSURE SYSTEM (0-2 PSIG OPERATING)

1. Seal off low pressure relief (7 PSI) SV-003-H.

2. Open manual valves MV-003-H and MV-002-H on low pressure, 8-inch manifold.

3. Connect point "C" to helium tube trailer.

4. Close manual valve MV-006-H on compressor 4-inch feed line.

TESTING OF LOW PRESSURE SYSTEM
(40 PSIG MAXIMUM ALLOWABLE PRESSURE, TEST 50 PSIG)

1. Have safety department inspect and approve test set up and equipment used.

2. All personnel must evacuate building.

3. Back off high pressure regulator.

4. Open one high pressure valve on helium feed trailer.

5. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

6. When pressure gauge PI-601-H on trailer feed line and pressure gauge PI-005-H reads 25 PSI, hold pressure for 10 minutes.

7. Enter building, snoop joints and welds for leaks; identify, mark and record any leaks.

8. Evacuate building.

9. Increase pressure in increments of 5 PSI to a maximum of 50 PSIG waiting 2 minutes between increments.

10. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure change) minimum 10 minutes.

11. Add gas if required to compensate for initial temperature change (do not exceed 50 PSI).

12. Reduce pressure to 25 PSI, then repressurize to 50 PSI, repeat 2 times.

13. If at the final pressure test of 50 PSIG, there are no pressure changes, the piping system will have passed the test.

14. Reduce system pressure to 25 PSI.

15. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

16. Reduce pressure in total system to 1 PSI with outside valves.

17. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

IN CONCLUSION

1. Have safety and Fermi Laboratory staff sign log and operation approval documents.

2. Disconnect tube trailer.

3. Remove all test equipment.

4. Replace relief valves on oil removal skids (SV-087-H) and SV-078-H with sensing line.

5. Remove plugs and reconnect high pressure relief SV-078-H.

6. Remove plug from low pressure 8-inch relief SV-003-H.

7. Reconnect as necessary instrument feed lines on kick back valve EV-097-H.

8. Open MV-013-H at compressor seal reservoir, MV-007-H on suction gauge. Also open MV-084-0 on coalescer oil return line.

9. Remove two (2) blanks and replace 2-inch check valve on 2-inch high pressure system. (CV-080-H)

10. Place all valves in normal operating position.

11. Inspect area.

12. Notify control room test is over.

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MYCOM COMPRESSOR SWITCHYARD BUILDING PRESSURE TEST PROCEDURE
Ref: Schematic Dwg. 1820-ME-112246
Carl B. Pallaver/John A. Satti

The compressor system consists of:

1. Mycom compressors designated number 1 & 2.

   a. Oil coolers
   b. Bulk oil knockouts

2. Oil removal elements

   a. No. 1 coalescer demister vessel mfg. by Monsanto
   b. No. 2 coalescer demister vessel mfg. by Monsanto
   c. No. 3 coalescer demister vessel mfg. by Monsanto
   d. Charcoal adsorber vessel mfg. by Howe Corp.
   e. Molecular sieve vessel mfg. by Howe Corp.
   f. Final filter vessel mfg. by Facet Enterprises.

3. Process piping

   a. Two and three-inch high pressure
   b. Four and eight-inch low pressure

Pressure vessels manufactured by outside firms have all been tested and are ASME code "U" stamped.

Only the process piping remains to be tested.

TEST SET UP PROCEDURE LOW AND HIGH PRESSURES

1. At compressors service lines close and lock out (1) two-inch valve on high pressure system #MV-090-H on each compressor

   Also on low pressure system suction line lock out (1) valve #SMV-450H

2. Provide gas nitrogen tube trailer with high pressure regulator, hand valves MV-600-H, pressure gauges PI-601-H, relief valves SV-600-H.

3. Break and blank off each compressor pilot operated relief valve SV-078-H. Install (1) SB-603-H relief valve at low pressure side. (This one relief protects both compressors low pressure piping). Add MV-604-H.

4. Install pressure gauge PI-005-H and manual valve MV-116-H at MV-002-H low pressure manifold and position outside building.

5. Remove SV-087-H relief valves located on each oil removal skid, and plug 3/4 N.P.T. line.

6. Add pressure gauge PI-055-H and manual valve MV-005-H to manual valve MV-089-H on oil skid final filter and position outside building connect a tube trailer line to point "A".

7. Add (1) pressure gauge P-112 and (1) manual valve MV-112-H to manual valve MV-088-H on 2-inch high pressure line and position outside building.

NOTE: On each compressor do the following:

8. Close manual valve MV-006-H (4-inch) compressor suction feed valve.

9. Close MV-013-H at compressor oil seal reservoir ACC-1.

10. Close MV-007-H at 14.7 PSIG compressor gauge.

11. Close MV-084-0. This valve is on #1 coalescer oil manifold return line.

12. Remove 2-inch check valve CV-080-H and blank off both sides.

HIGH PRESSURE TESTING

The high pressure system shall be split into two sections. One section to encompass the compressor from the 4-inch suction valve (MV-006-H) to the 2-inch discharge check valve (CV-080-H). This part to be tested at 406 PSI. This test shall be referred to as the compressor high pressure system.

The second section continues from the 2-inch discharge check valve through all 3 coalescers, charcoal, molecular sieve, final filter tanks. This part to be tested at 438 PSI and shall be referred to as the gas purification system.

TESTING COMPRESSOR HIGH PRESSURE SYSTEM

(MAXIMUM OPERATION 325 PSIG TEST 406 PSI)

1. On each compressor do the following:

   a. Close MV-013-H (compressor oil seal reservoir valves)
   b. Close MV-012-H (compressor low pressure gauge PI-012-H)
   c. Close MV-084-0 (coalescer oil manifold return valve)
   d. Close MV-007-H (compressor suction PI-007-H)
   e. Open and lock out 2-inch ball valve downstream of #2 coalescer MV-092-H

2. Low pressure relief (7 PSI SV-003-H) to be in operating condition.

3. On Nitrogen feed trailer connect line to point "B" (connects 2 compressors together).

4. Position all other valves not mentioned in the normal operating position.

5. Have a safety department inspect and approve test set up and equipment used.

6. All personnel must evacuate building.

7. Back off high pressure regulator.

8. Open one high pressure valve on nitrogen tube trailer.

9. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

10. Open manual valves MV-604-H on each compressor.

11. When pressure gauge PI-601-H on trailer feed line, and pressure gauge PI-113-H reads 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note these gauges must read within a few pounds of each other.)

12. Hold pressure of 10 minutes.

13. Enter building, snoop all joints and welds for leaks; identify, mark and record any leaks.

14. Evacutate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 406 PSIG.

15. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum 10 minutes.

16. Add gas if required to compensate for initial temperature change. (Do not exceed 406 PSI.)

17. Reduce pressure to 300 PSI then repressurize to 406 PSIG, repeat 2 times.

18. If at the final pressure test of 406 PSIG, there are no pressure changes, the piping system will have passed the test.

19. Reduce system pressure to 300 PSIG.

20. Enter building, snoop all joints and welds for leaks; identify mark, and record any leaks.

21. Reduce pressure in total high pressure system to 1 PSI.

22. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

23. Disconnect feed line at point "B".

HIGH PRESSURE GAS PURIFICATION SYSTEM

(MAXIMUM OPERATION 350 PSI, TEST 438 PSI)

1. Remove from normally closed EV-097-H kick back valve any electrical power or instrument air source.

2. Low pressure relief valve SV-003-H (7 PSI) must be in operating condition.

3. MV-088-H at final filter must be open.

4. Connect point "A" to tube trailer.

5. Close MV-090-H on 2-inch ring feed line.

6. Close MV-084-0 1/2-inch oil return line from coalescer manifold on each compressor.

7. Back off high pressure regulator.

8. Open one high pressure valve on nitrogen tube trailer.

9. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

10. When pressure gauge PI-601-H on trailer feed line, gauge PI-112-H and PI-114-H on high pressure manifold, and pressure gauges PI-055-H all read 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note all these gauges must read within a few pounds of each other.)

11. Hold pressure for 10 minutes.

12. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

13. Evacuate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 438 PSIG.

14. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum of 10 minutes.

15. Add gas if required to compensate for initial temperature change. (Do not exceed 438 PSI.)

16. Reduce pressure to 300 PSI then repressurize to 438 PSIG, repeat 2 times.

17. If at the final pressure test of 438 PSIG, there are no pressure changes, the piping system will have passed the test.

18. Reduce system pressure to 300 PSIG.

19. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

20. Reduce pressure in total high pressure system to 1 PSI outside the building.

21. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

LOW PRESSURE SYSTEM (0-2 PSIG OPERATION)

1. Seal off low pressure relief (7 PSI) SV-003-H.

2. Open manual vlaves MV-003-H and MV-002-H on low pressure, 8-inch manifold.

3. Connect point"C" to nitrogen tube trailer.

4. Close manual valve MV-006-H on compressor 4-inch feed line.

TESTING OF LOW PRESSURE SYSTEM

(40 PSIG MAXIMUM ALLOWABLE PRESSURE, TEST 50 PSIG)

1. Have safety department inspect and approve test set up and equipment used.

2. All personnel must evacuate building.

3. Back off high pressure regulator.

4. Open one high pressure valve on nitrogen feed trailer.

5. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

6. When pressure gauge PI-601-H on trailer feed line and pressure gauge PI-005-H reads 25 PSI, hold pressure for 10 minutes.

7. Enter building, snoop joints and welds for leaks; identify, mark and record any leaks.

8. Evacuate building.

9. Increase pressure in increments of 5 PSI to a maximum of 50 PSIG waiting 2 minutes between increments.

10. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure change) minimum 10 minutes.

11. Add gas if required to compensate for initial temperature change (do not exceed 50 PSI).

12. Reduce pressure to 25 PSI, then repressurize to 50 PSI, repeat 2 times.

13. If at the final pressure test of 50 PSIG, there are no pressure changes, the piping system will have passed the test.

14. Reduce system pressure to 25 PSI.

15. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

16. Reduce pressure in total system to 1 PSI with outside valves.

17. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

IN CONCLUSION

1. Have safety and Fermi Laboratory staff sigh log and operation approval documents.

2. Disconnect tube trailer.

3. Remove all test equipment.

4. Replace relief valves on oil removal skids (SV-087-H).

5. Remove plugs and reconnect high pressure relief SV-078-H.

6. Remove plug from low pressure 8-inch relief SV-003-H.

7. Reconnect as necessary instrument feed lines on kick back valve EV-097-H.

8. Open MV-013-H at compressor seal reservoir, MV-007-H on suction gauge. Also open MV-084-0 on coalescer oil return line.

9. Remove two (2) blanks and replace 2-inch check valve on 2-inch high pressure system. (CV-080-H)

10. Place all valves in normal operating position.

11. Inspect area.

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MYCOM COMPRESSOR B0 BUILDING PRESSURE TEST PROCEDURE
Ref: Schematic Dwg. #9140-ME-129804
Carl B. Pallaver/John A. Satti

The compressor system consists of:

1. Mycom compressors designated number 1,2,3,4..

   a. Oil coolers
   b. Bulk oil knockouts

2. Oil removal elements

   a. No. 1 coalescer demister vessel mfg. by Monsanto
   b. No. 2 coalescer demister vessel mfg. by Monsanto
   c. No. 3 coalescer demister vessel mfg. by Monsanto
   d. Charcoal adsorber vessel mfg. by Howe Corp.
   e. Molecular sieve vessel mfg. by Howe Corp.
   f. Final filter vessel mfg. by Dollinger

3. Process piping

   a. Two and three-inch high pressure
   b. Four and eight-inch low pressure

Pressure vessels manufactured by outside firms have all been tested and are ASME code "U" stamped.

Only the process piping remains to be tested.

TEST SET UP PROCEDURE LOW AND HIGH PRESSURES

1. At ring service lines close and lock out (4) three-inch valves on high pressure system MV-009-H, MV-411-H and (1) unmarked valve, (1) 1/4 MV-414-H.

   Also (3) eight-inch valves on low pressure system MV-401-H, MV-402-H and MV-001-H.

2. Provide gas helium tube trailer with high pressure regulator, hand valves MV-600-H, pressure gauges PI-601-H, relief valves SV-600-H.

3. Break and blank off each compressor pilot operated relief valve SV-630-H. Install (1) SB-603-H relief valve at low pressure side. (This one relief protects both compressors low pressure piping). Add MV-604-H.

4. Install pressure gauge PI-005-H and manual valve MV-116-H at MV-002-H low pressure manifold and position outside building.

5. Remove SV-087-H relief valves located on each oil removal skid, and plug 3/4 N.P.T. line.

6. Add pressure gauge PI-055-H and manual valve MV-005-H to manual valve MV-089-H on oil skid final filter and position outside building connect a tube trailer line to point "A". This applies to all skids on system.

7. Add (1) pressure gauge P-112 and (1) manual valve MV-112-H to manual valve MV-089-H on 2-inch high pressure line and position outside building.

NOTE: On each compressor do the following:

8. Close manual valve MV-006-H (4-inch) compressor suction feed valve.

9. Close MV-013-H at compressor oil seal reservoir ACC-1.

10. Close MV-007-H at 14.7 PSIG compressor gauge.

11. Close MV-084-0. This valve is on #1 coalescer oil manifold return line.

12. Remove 2-inch check valve CV-080-H and blank off both sides.

HIGH PRESSURE TESTING

The high pressure system shall be split into two sections. One section to encompass the compressor from the 4-inch suction valve (MV-006-H) to the 2-inch discharge check valve (CV-080-H). This part to be tested at 406 PSI. This test shall be referred to as the compressor high pressure system.

The second section continues from the 2-inch discharge check valve through all 3 coalescers, charcoal, molecular sieve, final filter tanks, up to the 3-inch manifold valves (MV-099-H). This part to be tested at 438 PSI and shall be referred to as the gas purification system.

TESTING COMPRESSOR HIGH PRESSURE SYSTEM

(MAXIMUM OPERATION 325 PSIG TEST 406 PSI)

1. On each compressor do the following:

   a. Close MV-013-H (compressor oil seal reservoir valves)
   b. Close MV-012-H (compressor low pressure gauge PI-012-H)
   c. Close MV-084-0 (coalescer oil manifold return valve)
   d. Close MV-007-H (compressor suction PI-007-H)
   e. Open and lock out 2-inch ball valve downstream of #2 coalescer

2. Low pressure relief (7 PSI SV-003-H) to be in operating condition.

3. On Helium feed trailer connect line to point "B" (connects 4 compressors together).

4. Position all other valves not mentioned in the normal operating position.

5. Have a safety department inspect and approve test set up and equipment used.

6. All personnel must evacuate building.

7. Back off high pressure regulator.

8. Open one high pressure valve on nitrogen tube trailer.

9. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

10. Open manual valves MV-604-H on each compressor.

11. When pressure gauge PI-601-H on trailer feed line, and pressure gauge PI-113-H reads 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note these gauges must read within a few pounds of each other.)

12. Hold pressure of 10 minutes.

13. Enter building, snoop all joints and welds for leaks; identify, mark and record any leaks.

14. Evacutate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 406 PSIG.

15. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum 10 minutes.

16. Add gas if required to compensate for initial temperature change. (Do not exceed 406 PSI.)

17. Reduce pressure to 300 PSI then repressurize to 406 PSIG, repeat 2 times.

18. If at the final pressure test of 406 PSIG, there are no pressure changes, the piping system will have passed the test.

19. Reduce system pressure to 300 PSIG.

20. Enter building, snoop all joints and welds for leaks; identify mark, and record any leaks.

21. Reduce pressure in total high pressure system to 1 PSI.

22. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

23. Disconnect feed line at point "B".

HIGH PRESSURE GAS PURIFICATION SYSTEM

(MAXIMUM OPERATION 350 PSI, TEST 438 PSI)

1. Remove from normally closed EV-097-H kick back valve any electrical power or instrument air source.

2. Low pressure relief valve SV-003-H (7 PSI) must be in operating condition.

3. MV-089-H at final filter must be open.

4. MV-098-H at 3-inch, 3-vlave manifold must be open.

5. Connect point "A" to tube trailer.

6. Close MV-090-H, MV-411-H, MV-412-H, on 3-inch ring feed line manifold.

7. Close MV-084-0 1/2-inch oil return line from coalescer manifold on each compressor.

8. Back off high pressure regulator.

9. Open one high pressure valve on nitrogen tube trailer.

10. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

11. When pressure gauge PI-601-H on trailer feed line, gauge PI-112-H and PI-114-H on high pressure manifold, and pressure gauges PI-055-H all read 25 PSI, continue in steps of 25 PSI until 200 PSI is reached. (Note all these gauges must read within a few pounds of each other.)

12. Hold pressure for 10 minutes.

13. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

14. Evacuate building, gradually increase pressure in increments of 35 PSI to a maximum pressure of 438 PSIG.

15. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure changes) minimum of 10 minutes.

16. Add gas if required to compensate for initial temperature change. (Do not exceed 438 PSI.)

17. Reduce pressure to 300 PSI then repressurize to 438 PSIG, repeat 2 times.

18. If at the final pressure test of 438 PSIG, there are no pressure changes, the piping system will have passed the test.

19. Reduce system pressure to 300 PSIG.

20. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

21. Reduce pressure in total high pressure system to 1 PSI outside the building.

22. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

LOW PRESSURE SYSTEM (0-2 PSIG OPERATION)

1. Seal off low pressure relief (7 PSI) SV-003-H.

2. Open manual vlaves MV-003-H and MV-002-H on low pressure, 8-inch manifold.

3. Connect point"C" to helium tube trailer.

4. Close manual valve MV-006-H on compressor 4-inch feed line.

TESTING OF LOW PRESSURE SYSTEM

(40 PSIG MAXIMUM ALLOWABLE PRESSURE, TEST 50 PSIG)

1. Have safety department inspect and approve test set up and equipment used.

2. All personnel must evacuate building.

3. Back off high pressure regulator.

4. Open one high pressure valve on helium feed trailer.

5. Engage high pressure regulator until pressure gauge PI-601-H reads 25 PSI.

6. When pressure gauge PI-601-H on trailer feed line and pressure gauge PI-005-H reads 25 PSI, hold pressure for 10 minutes.

7. Enter building, snoop joints and welds for leaks; identify, mark and record any leaks.

8. Evacuate building.

9. Increase pressure in increments of 5 PSI to a maximum of 50 PSIG waiting 2 minutes between increments.

10. Hold pressure until system is stable (i.e., thermal equilibrium, no pressure change) minimum 10 minutes.

11. Add gas if required to compensate for initial temperature change (do not exceed 50 PSI).

12. Reduce pressure to 25 PSI, then repressurize to 50 PSI, repeat 2 times.

13. If at the final pressure test of 50 PSIG, there are no pressure changes, the piping system will have passed the test.

14. Reduce system pressure to 25 PSI.

15. Enter building, snoop all joints and welds for leaks; identify, mark, and record any leaks.

16. Reduce pressure in total system to 1 PSI with outside valves.

17. Close high pressure trailer valves, bleed off all gas from outside valves and back off high pressure regulator.

IN CONCLUSION

1. Have safety and Fermi Laboratory staff sigh log and operation approval documents.

2. Disconnect tube trailer.

3. Remove all test equipment.

4. Replace relief valves on oil removal skids (SV-087-H).

5. Remove plugs and reconnect high pressure relief SV-078-H.

6. Remove plug from low pressure 8-inch relief SV-003-H.

7. Reconnect as necessary instrument feed lines on kick back valve EV-097-H.

8. Open MV-013-H at compressor seal reservoir, MV-007-H on suction gauge. Also open MV-084-0 on coalescer oil return line.

9. Remove two (2) blanks and replace 2-inch check valve on 2-inch high pressure system. (CV-080-H)

10. Place all valves in normal operating position.

11. Inspect area.

NOTE: Doubler Cryogenic system is now in operating condition any gas during testing and purging must be clean helium has.

SATELLITE COMPRESSOR SYSTEM
PROCEDURES FOR MAJOR LEAK REPAIRS

John Satti
May 23, 1983

This procedure is for repairing major leaks in the compressor system where the inside of the piping and or vessel surfaces are exposed to atmosphere conditions. Examples are weld repair of vessel and connections and removal of pipe sections or valves.

The purpose of the procedure is to first enforce safety rules in an OXYGEN DEFICIENCY AREA and second to minimize the contamination problems that exist when ever any helium gas system is opened to atmosphere.

Important

When working in an OXYGEN DEFICIENCY AREA, the Safety Manual Procedures Ch. 15.1 on CXYGEN DEFIENCY HAZARDS shall be followed.

Large amount of helium gas could excape from opened connections displacing air from the room you are working in. Always vent working gases outside the building you are working in and into the atmosphere.

Procedure

1. Inform and get permission from the Control Room Refrigerator Chief Operator to shutdown the compressor to be repaired.

2. Refer to Compressor piping and instrumentation drawing No. 9140-ME-129720 latest revision.

3. Shut compressor down and lock out power supply. Turn off power breakers inside panel box and lock out.

4. Close and tag the 2" ball valve MV-090-H downstream of the final filter.

5. Close and tag the 4" butterfly valve MV-006-H at the suction of the compressor.

6. The leak in the system could have contaminated the oil and the helium gas. Bleed down to atmosphere pressure the helium gas in the compressor system. Vent the gas outside the building.

CAUTION: Follow Safety Manual CH. 15.1 OXYGEN DEFIENCY HAZARDS

7. Where removal of the oil is required for a weld repair, clean inside oily surface with a solvent approved by the safety department. After cleaning, purge well with helium gas to remove the vapor from the system.

8. Keep a helium purge in the compressor system during repair work. This will reduce contamination and will give an inert gas atmosphere required for any weld repair.

9. After repair work and prior to a leak check, pump out and purge with clean helium gas two times. Leak check with clean helium gas.

10. Where welding was done on pipes, vessels, or other components, the system has to be retested to 1.25 times the maximum allowable working pressure. A permit is required for this test. Refer to "Mycom Compressor Building Pressure Test Procedures". ASME pressure vessels repair requires approval from certified inspector. Refer to ASME Code Sec. VIII.

    NOTE: use only clean helium gas for the test.

11. Before the final test, relief valve SV-087-H (350 psi) on the adsorber skid has to be plugged up. For the pilot operated relief valve SV-078-H (325 psig), the pilot valve must be disconnected. The main valve dome volume must be connected to the inlet pressure. Under test the main valve will not open because the dome area is 30% larger than the inlet area.

12. After the test has been completed and witnessed, bleed the gas to atmosphere outside the building.

13. Recommission the relief valves for normal operation. Remove the plug from SV-087-H and reconnect the pilot valve to SV-078-H. NOTE: certified setting on the pilot valve shall not be changed.

14. Replace the oil with a minimum of contamination added to the system. (purge top of oil barrel with helium gas)

15. Pressurize the compressor to 30 psig helium gas from the high pressure manifold. Use a clean line, purged with helium, to supply the gas to valve MV-005-H at the compressor suction.

    Turn the oil pump and the heater on and purge with helium from the high pressure manifold. Purge through the complete compressor system and vent out to atmosphere from valve MV-089-H after the final filter. Purge for 30 minutes.

16. Turn oil pump off close purging valves and pump down to 28 inches of mercury vacuum.

17. Repeat step 15 after pressurizing with clean helium from high pressure manifold.

18. Repeat step 16 and pressurize system to 150 psig from high pressure helium manifold. Remove purge line.

19. Open slowly valves MV-090-H and MV-006-H and remove tags. Unlock power supply breakers and call control room for compressor startup and back to operation. Record repair work done on log book.

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SATELLITE COMPRESSOR SYSTEM

Procedures for changing the Compressor Motor

John A. Satti
June 23, 1983

This procedure is for changing the 350/400 HP motor from the compressor frame assembly.

Motor weights		Approx. weight
General Electric	350 HP, 445TS aluminum frame	1010 lbs.
Siemens Allis	350 HP, 447TS frame	1500 lbs.
Louis Allis	350 HP, 447TS frame	1600 lbs.
Louis Allis	400 HP, 447TS frame	1800 lbs.

The fixture designed to lift the motor off and on the compressor frame shall be used. Check the spare motor for proper fit. The Accelerator Safety Section shall designate a person responsible for conducting the motor removal operations. All groups involved in the motor change shall receive their direction and be responsive to the above designee.

IMPORTANT

When working in an OXYGEN DEFICIENCY AREA, the Safety Manual Procedures Ch. 15.1 on Oxygen Deficiency Hazards shall be followed.

Large amounts of helium gas could escape from broken pipes displacing air from the room you are working in. Always vent working gases outside the building you are working in and into the atmosphere.

PROCEDURE

1. Inform and get permission from the Control Room Refrigerator Chief Operator to change the defective motor and shut-down the adjacent compressor next to the oil pump side.

2. Put the compressor, with the motor to be changed and the adjacent one, to the left facing the control panel, in LOCAL control.

3. Turn off both compressors with the STOP button on the panels.

4. Turn off the control power to the compressors and the 800 amp breaker at the starter cabinet. Lock-out all switches.

5. In the starter cabinet of the compressor with the motor change, check each phase of the motor conductors (voltage to ground).

6. Close and tag the 2" ball valve MV-090-H downstream of the final filter. Do this for both compressors. Refer to drawing No. 9140-ME-129720.

7. Close and tag the 4" butterfly valve MV-006-H at the suction of the compressor. Do this for both compressors.

8. Depressurize the adjacent compressor system to a maximum of 50 psig. Connect a 1/2" copper line from valve MV-084-H downstream of the second coalescer to valve MV-003-H at the suction manifold. Purge line well for 2 minutes (~2 SCFM) before connecting to suction.

9. Depressurize the compressor system with the motor to be changed to 3-5 psig. Use copper line as in step 8. Always purge line will to minimize gas contamination.

10. After depressurization and make sure that all power to the defective motor is off, remove the connection box and disconnect the electrical conductors.

11. Disconnect the motor from the compressor shaft and frame. Coupling safety cover, (double-flexing disc coupling, and bolts to frame).

12. Remove the motor to be changed with the fixture provided for. Note that the motor shall not exert any force on any compressor system component (pipes, tubing, vessels, instrumentation, for both compressors). Follow instructions from the safety person responsible.

13. Replace with a new or rebuilt motor making sure of proper clearances prior to lifting the motor in place. Again do not touch any compressor system components. This holds for the adjecent compressor as well.

14. Align the motor to the requirements as stated in the compressor manual.

15. Plant Maintenance shall do the electrical connection to the motor. The motor shall be Hi-potted and checked for proper rotation by Plant Maintenance personnel.

16. Pressurize both compressor systems to 50 psig. Use 1/2" line from high pressure manifold valve MV-098-H to compressor suction valve MV-005-H dwon-stream of the suction strainer. Before connecting line, purge for 2 minutes (~2 SCFM) the copper line.

17. Disconnect lines and open valves MV-090-H (2" ball valve) and MV-006-H (4" Butterfly valve).

18. Put compressors in REMOTE operation and call Control Room for ready compressors START-UP.

SATELLITE COMPRESSOR SYSTEM

Procedure for Changing the Pilot Operated Safety Relief Valve

John A. Satti
May 10, 1983

This procedure is for changing defective AGCO Pilot Operated Relief Valves (SV-078-H). The valves are located upstream of each compressor suction on the 4 inch vertical pipe. Normal suction pressure is between 1 and 5 psig.

The valve assembly consists of a pilot valve which activates the main relief valve. The name plate set pressure is 325 psig; however the pilot cracking pressure is approximately 314 psig.

IMPORTANT

When changing the relief valve, a large quantity of helium gas will escape from the opened connections. The Safety Manual Procedure Ch. 15.1 on OXYGEN DEFICIENCY HAZARDS shall be followed.

Safety personnel shall be present to verify safety conditions.

Magnet quenches shall not be permitted during valve change. This can increase the suction pressure to 22 psig. Each new valve shall be checked for proper cracking pressure. The new valve shall have ready matching connections prior to starting installation.

PROCEDURE

1. Inform and get permission from the Control Room Refrigerator Chief Operator to shutdown the compressor with the defective valve. NOTE: ask operator to maintain a POSITIVE suction pressure in the 8 inch manifold after the compressor is shutdown.

2. Refer to Compressor piping and instrumentation drawing No. 9140-ME-129720.

3. Shut compressor down and lock out power supply. Turn off power breakers inside panel box and lock out.

4. Close and tag the 2" ball valve MV-090-H downstream of the final filter.

5. Close and tag the 4 inch butterfly valve MV-006-H at the suction of the compressor.

6. Bleed down to suction pressure into the 8 inch manifold the helium gas in the compressor system. NOTE: bleed down both sides of the check valve CV-080-H downstream of the after cooler AC-1. Always purge line first.

   CAUTION: Follow Safety Manual Ch. 15.1 OXYGEN DEFIENCY HAZARDS

7. Connect a clean 1/4 inch line from the 3 inch high pressure manifold to valve MV-005-H at the compressor suction. Regulate the pressure to supply <0.5 psig of helium gas for positive purging while removing the safety relief valve.

8. With most leaking valves, the pilot valve may have a dirty seal. In this case, the pilot valve is the only valve that needs to be changed. Only 3/8 inch tube connections need to be opened.

9. Verify leak in pilot valve

   a. Disconnect the pilot valve from compressor system.
   b. Plug up opened tubes from compressor system.
   c. Pressurize inlet to pilot valve with helium gas from bottle and check cracking pressure.

10. Replace pilot valve only or main valve assembly as required NOTE: replacing main valve large amount of helium gas will escape from the 2 inch opening from suction manifold. Refer to ODH Ch. 15.1 for safety.

11. Low pressure (<0.5 psig) helium gas purging shall flow through any opened connection from the compressor.

12. Tighten all joints and leak check the high pressure compressor side of the valve as follows:

    a. Pressurize with clean helium gas to 200 psig wait 10 min and leak check.

    b. If tight continue to 300 psig wait 10 min. and leak check.

    Use safety precautions as with normal piping pressure tests.

13. The low pressure manifold suction side of the valve can only be checked for leaks with the low operating suction pressure (1 to 5 psig)

14. After installation of new relief valve, open slowly, valves MV-090-H and MV-006-H and remove tags. Unlock Power supply breakers and call control room for compressor startup. Record the valve serial number and the hours of the compressor.

Fermilab

December 6, 1982

DEHYDRATION PROCEDURE OF MYCOM COMPRESSOR

C.B. Pallaver/J. Satti

This procedure is required for testing and removal of water prior to introducing Helium Gas into the compressor system.

EQUIPMENT REQUIRED

Liquid Nitrogen Trailer (with instrumentation),flow meters (0-1000 SCFH),Portable Panametric Hygrometer,misc. tubes and fittings (1/2 & 1/4 cu lines).

DRAWINGS REQUIRED

Fermilab #9140-ME-129720-A
Sketch - 1001

PROCEDURE

1. Turn on HTR-I (oil reservior heater).
2. Close MV-006-H (4 inch suction valve).
3. Close MV-090-H (2 inch discharge valve).
4. Connect LN_2 trailer gas line to MV-009-H, (1/2 copper tube).
5. Connect 1/2 vent line to MV-081H upstream of #1 coalescer tank.
6. Connect 0-1000 SCFH flow meter to vent line, connect 1/4 tee line to Panametric sensor, vent both lines outside building.
7. Close MV-084-0 (coalescer manifold to comp return oil valve)
8. Pressurize system 30 to approx. 40 psig with Nitrogen gas.
9. Start oil pump.
10. Crack open MV-081H (coalescer valve) till flow meter reads $\approx$ 250 SCFH.
11. Record oil and gas temperatures , gas pressures, flow SCFH, and dew points, before and after compressor every four hours.

12. When dewpoint is less than ≈ -70°C (≈3PPM on volume), stop oil pump, and close MV-009-H, close MV-081-H.

13. Note that the four compressors in a service building are dehydrated at the same time. A liquid nitrogen trailer is required to assure sufficient gas with low dew point temperature.

"IMPORTANT" all purged gas must be vented to atmosphere outside bldg.

Allow NO vented gas to enter building or any confined area.

Fermilab

ACCELERATOR DIVISION
MOLECULAR SIEVE INSTALLATION

C. Pallaver/J. Satti

The molecualr sieve adsorbent bed is part of the Satellite Helium Refrigerator purification system. Its main purpose is to remove water vapor from the helium gas.

When the water vapor is adsorbed within the molecular sieves it is difficult and time consuming to remove.

Thus it is important that the sieve be exposed to the atmosphere as short a time as possible and be the last item introduced into the system.

These conditions should be met prior to and during the installation of the molecular sieves into the vessel on the adsorbent skid package:

SAFETY PRECAUTION

1. Molecular sieve dust and pellets are an irritant and must be handled with care.

2. Hands, eyes, and lungs must be protected with proper safety devices such as gloves. Eye goggles, and breathing filters of the heavy duty type are provided by the Safety Dept.

3. Avoid using on a windy day. Proper ventilation is necessary when handling in an enclosed area.

4. In the event any molecular sieve enters the eye flush will with clean water and obtain medical assistance. Wash hands will after using.

5. Obtain and display No Smoking signs, allow no open flame or sparking during filling procedure.

INSTALLATION PROCEDURE

1. After the dehydration of the charcoal adsorbent vessel, the gas system in the compressors and piping shall have a recorded dewpoint temperature of -70°C using nitrogen gas purging. The nitrogen purging shall be done with the compressor oil pumps running and with the oil heaters on. The object is to remove any moisture trapped in the oil. (Ref.: Compressor System Dehydration Procedure)

2. Purge the complete compressors, oil removals, and adsorbent skid systems with helium gas. Provide a continuous purge of helium gas with .5 psig maximum to 2 inches water minimum.

3. The molecular sieves must mot be installed during inclement weather such as rain, snow etc. Preferably dry sunny days.

4. Open one supply drum at a time and introduce as quickly as possible.

5. If for any reason the filling operation is delayed, seal the opened drum and molecular sieve vessel.

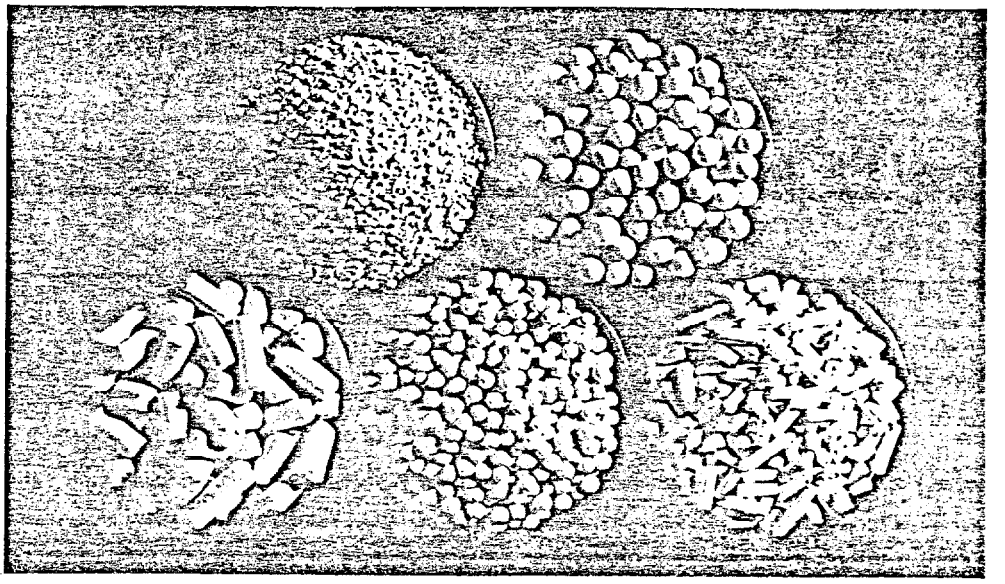
6. Immediately after filling the molecular sieve vessel, replace the fill flange using a new gasket.

7. Vacuum pump the total system or any part that was opened to less than 500 microns. Back fill with helium gas.

8. Pump and purge with He until gas instrumentations reads less than -70^{o}C dew point temperature. Record any gas contaminants (if instrumentation is available).

9. Record all data.

cc: Satellite Refrigeration Group
Cryogenic Systems Group
Accelerator Safety Group
H. Edwards
W. Fowler
R. Orr



NOTE: Protect yourself and others. Read and understand this section thoroughly before loading fresh molecular sieves. Observe all shipping container precaution labels.

Molecular sieves are typically supplied as pellets, beads or mesh.

In their fresh, unused state, molecular sieves are not flammable. When exposed to water, however, they can get quite hot. When first wetted, molecular sieves can heat to the boiling point of water. For this reason, you should not put molecular sieves into your mouth or allow them to touch your eyes.

Note: It is possible to manufacture special molecular sieves with toxic or flammable materials added. Those molecular sieves require special precautions on the labels of the shipping containers and in the material safety data sheets. In such cases, always follow the special precautions provided by the manufacturer.

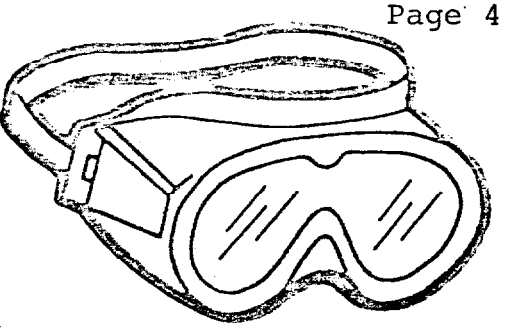
Molecular sieve dust may irritate your nose, throat, eyes, lungs and skin. Since some dust may be present when you load fresh molecular sieves, you should wear eye protection, dust masks, gloves, and clothing that covers your body.

Molecular sieves are normally shipped in 55-gallon sealed drums or 35-cubic-foot bags. Occasionally, pneumatic trucks are used.

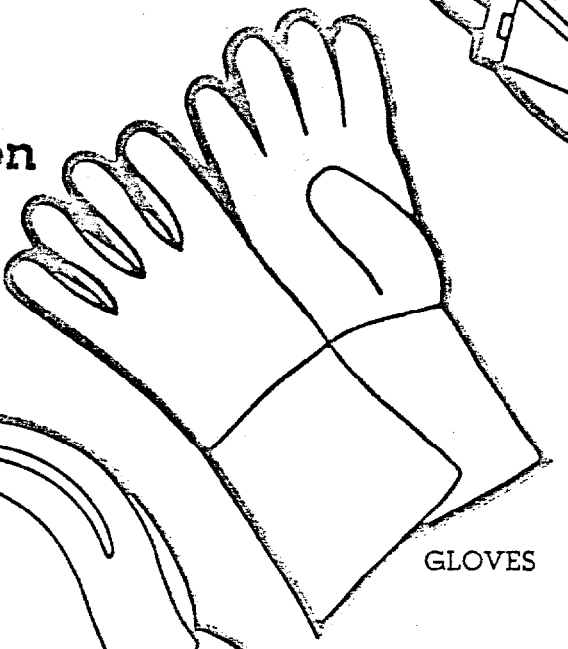
A vacuum may exist inside the removable-top drums. If you force the lid off, air may rush in and spray the particles about. First, loosen the vent screw on the lid and break the vacuum. Then remove the top.

ACCELERATOR DIVISION MOLECULAR
SIEVE INSTALLATION

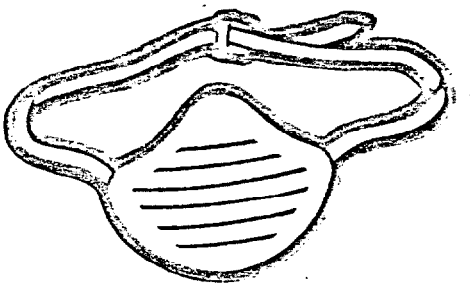
Safety/Protection Equipment



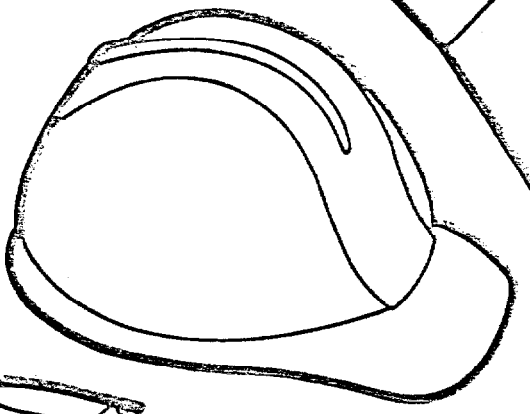
GOGGLES



GLOVES

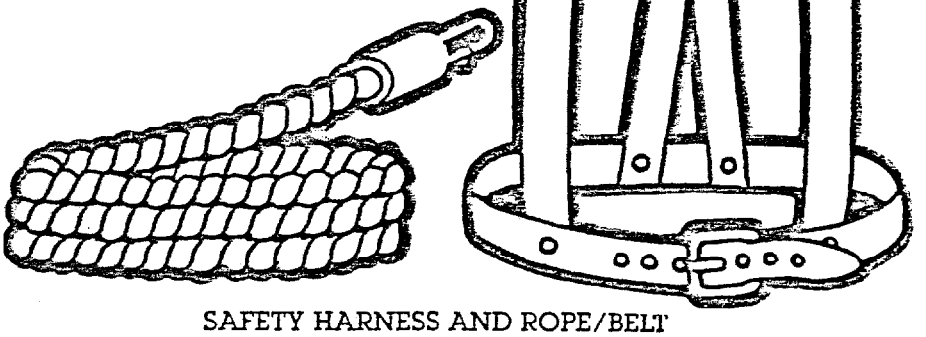


DUST MASK

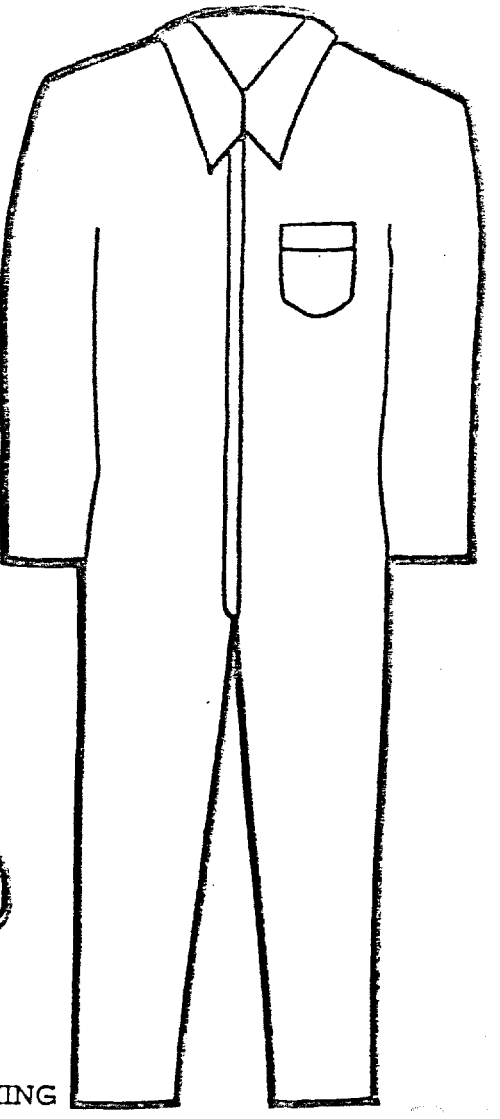


HARD HAT

SAFETY SHOES



SAFETY HARNESS AND ROPE/BELT



PROTECTIVE CLOTHING

ZERO COMPRESSOR BUILDING
MOLECULAR SIEVE CHANGE

C.B. Pallaver
April 25, 1983

CONDITIONS

1. Energy Saver helium system in operation
2. Existing molecular sieve has high dewpoint.

PROCEDURE

1. Inform Main Control Room which compressors shall be shut down record time and main control room chiefs name.
2. Reference drawing number 9140-ME-129844.
3. Reference standard procedure Accelerator Division Molecular Sieve Installation - Dated 11-9-82.
4. Connect helium tube trailer to MV-088-H at final filter on purifier skid.
5. Connect vacuum pump to MV-087-H purifier skid, 4 inch low pressure ball valve.
6. Connect 0-1000 Micron Gauge to MV-089-H at final filter on purifier skid, and at MV-008-H 4 inch low pressure strainer valve.
7. Shut down all compressors in Zero Building.
8. Close MV-001-H low pressure header
   Close MV-006-H low pressure header
   Close MV-092-H H.P. C-20 Line
   Close MV-093-H H.P. C-20 Line
   Close MV-090-H H.P. Header
9. Bleed down to atmosphere outside building helium gas in system to zero psig.
10. Follow standard molecular sieve installation instructions.
11. After installation remove all equipment.
12. Notify control room system is ready for standard helium purification with LN_2 purifier.
13. Record all, clean area, mark old molecular sieve drums as used sieve and place in storage.

Fermilab

ACCELERATOR DIVISION

CHARCOAL PELLET INSTALLATION AND DEHYDRATION

C. Pallaver/J. Satti
March 9, 1983

The charcoal absorbent bed is part of the helium refrigerator purification system Its main purpose is to remove oil vapor from the helium gas. The Charcoal Pellets as delivered contain about 2% by weight of moisture (~ 12 lbs of water in the bed). This moisture has to be removed as described in the Dehydration Procedure below.

During the installation of the pellets, minimize the exposure of the pellets to the atmosphere to reduce moisture pickup.

SAFETY PRECAUTION

1. Charcoal pellets and dust can irritate the eyes and as with any dusty substance must be handled with care.

2. Hands, eyes, and lungs must be protected with proper safety devices such as gloves. Eye goggles, and breathing filters of the heavy duty type are to be obtained from the Safety Department.

3. The charcoal pellets should not be installed during inclement weather such as rain, snow etc., preferably dry sunny days. Proper ventilation is necessary when handling in an enclosed area.

4. Obtain and display No Smoking signs, allow no open flame or sparking during filling procedure.

5. Should the charcoal vessels be within a building or confined area, all vent lines must be placed outside building. Nitrogen gas can easily replace breathing air creating oxygen deficiency hazards. Follow procedures in Chapter 15.1 of the Safety Manual.

6. Prior to turning on any electrical equipment check all components and inspect wires for looseness, frays, burn insulation etc.

Installation

1. All openings on vessel particularly the 4 inch 300 pound bling flange at the base of the vessel should have been tested and bubble tight. Verify that this test has been done.

2. Verify that there is no pressure then remove 4 inch 300 pound blind flange at the top of the vessel, discard the gasket.

3. Open one supply drum at a time and introduce as quickly as possible.

4. If for any reason the filling procedure is delayed, seal the opened drum and charcoal vessel.

5. During filling use a vibrator or strike the outside of the vessel with a soft hammer causing the charcoal to settle in place.

6. Immediately after filling the charcoal vessel, replace the fill flange using a new gasket.

Dehydration

1. Equipment Required.

   Dew point analyzer
   1/2 copper tube and fittings
   Liquid nitrogen trailer with 45 psig relief valve
   (2) 3 KW heater 220 V.
   (2) 1 1/2 KW heater 220 V.
   (10) 55 gallon strap heaters (220 V. 1 1/2 KW)
   insulation as required
   thermocouples 0-600°F.
   gas to gas heat exchanger
   (1) 0-1000 SCFH flow meter

2. Connect equipment as per included Drawing No.9140-MB-129816.
   NOTE 2 charcoal vessels may be dehydrated in parallel.
   During cold weather prevent moisture from freezing and plugging vent line which may occur when dew point is very high.

3. Introduce dry nitrogen with flow rate of approx. 400 SCFH per vessel.

4. Continue flow until temperature at exit of vessel (2" flange) reaches 375°F and dewpoint is less than 3 ppm.

5. Remove any relief, hand valves, or other equipment that are manufactured of materials that may be damaged by high temperature.

6. Upon completion close off system with positive nitrogen pressure (5 to 20 psig)

7. Reference flow sheet drawing 9140-ME-129720-D for Compressor Buildings piping and instrumentation flow diagram.

FINAL PUMP AND HELIUM PURGE PROCEDURE FOR MYCOM COMPRESSOR SYSTEM

C. Pallaver/J. Satti

A. Prior to this procedure the following criteria must be completed:

1. Complete leak check of compressor system.
2. Final pressure check and safety approval.
3. Compressor motor, oil pump, and instrumentation check out, and minimum 4 hour operation.
4. Compressor water degydration resulting in less than -70^{o}C dew point (3 ppm on volume at 1 ATM). (see compressors dehydration procedure)
5. Charcoal installation and dehydration to <- 70^{o}C dew point.
6. Molecular sieve installation. (see molecular sieve installation procedure)

B. Safety Requirements

1. All purged gas must be vented to atmosphere outside building.
2. Allow NO vented gas to enter building or any confined area.

C. Equipment required to perform this procedure:

1. Vacuum pumps
2. Helium tube trailer (check dew point <- 80^{o}C for clean gas) with well supported high pressure regulator and shut off valve.
3. Flow meter 0 to 500 SCFH.
4. 1/2" copper tube and misc. fittings. (300 psi rated minimum)

5. Vacuum instrumentation 0-1000 microns.

6. Moisture analyzer to measure less than - 100°C dew point at 1 atm. (.0130 ppm, volume)

D. Procedure (Ref. Drw. #9140-MB-129720-D)

1. Connect vacuum pump to MV-009H (4 inch suction line)

2. Connect helium trailer to MV-002-H (8 inch suction line).

3. Connect purge line with flow meter, hygrometer, and air analyzer (if available), to MV-086-H (number 3 coalescer).

4. All valves placed in the normal operating condition except.

   a. Close MV-412, MV-411-H, and MV-099H (3" ball valves at high pressure discharge manifold).

   b. Close MV-401-H, MV-402-H, and MV-001-H. (8" butterfly vlaves at low pressure suction manifold).

   c. Close valve at tube trailer.

5. Pump on entire system until vacuum reads less than 500 microns back fill with helium gas, repeat 3 times.

6. On the third back fill purge helium gas through MV-86-H (number 3 coalescer) at a rate of approx. 200 SCFH. Record input and output helium gas for contamination.

7. Continue purging until dew point and air contamination is less than ~ 3 parts per million. (-69°C)

NOTE: Two of more compressor systems may be purged in parallel but each system must be instrumented individually.

8. As a final check, purge a small amount approx. 10 min. of helium gas through MV-098-H (3 inch high pressure 3 valves manifold) contamination should be less than 3 parts per million of air and moisture. If not repeat entire procedure.

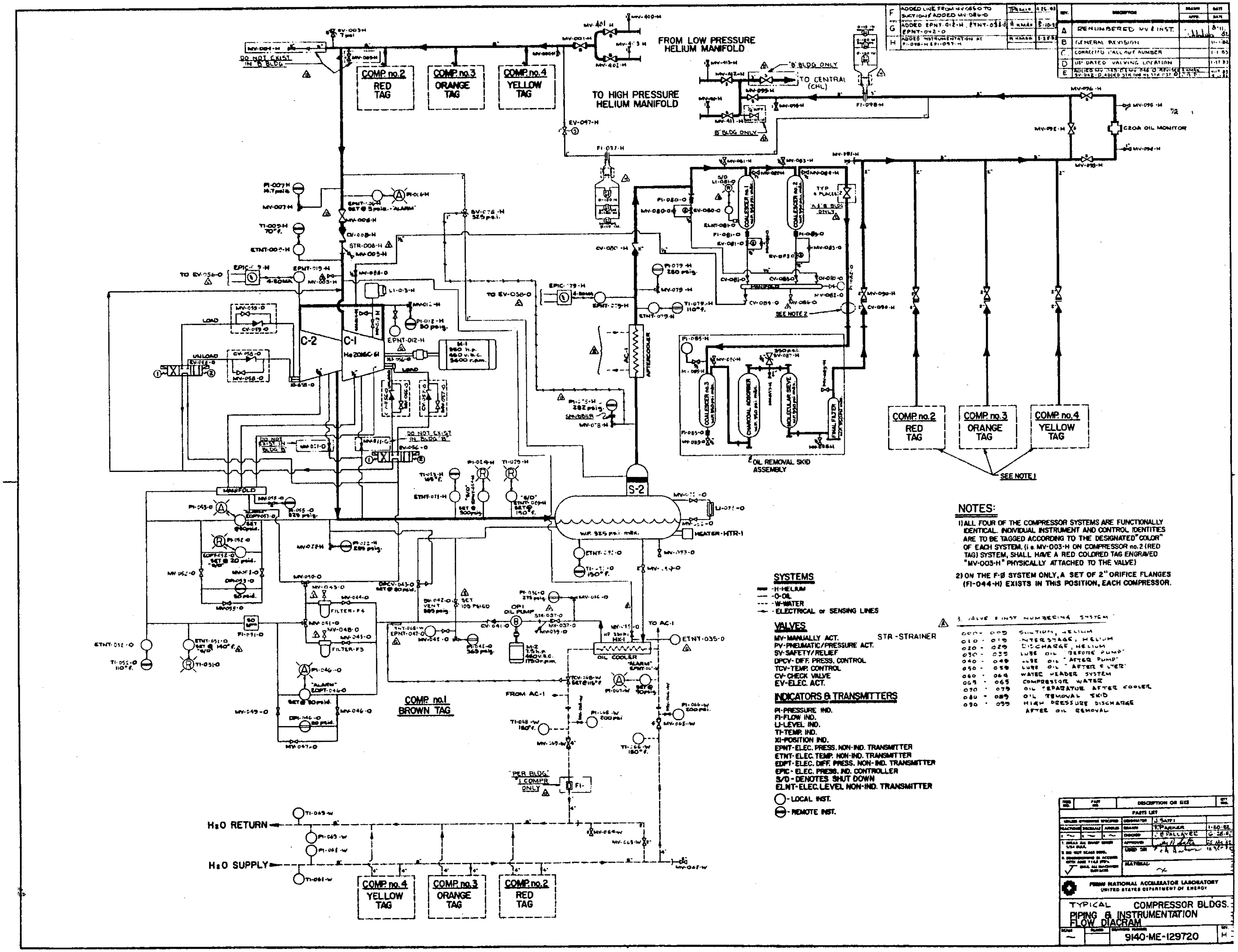
E. Final sealing of system

1. Record time required to complete this operation for each compressor system.

2. Close MV-086-H (#3 coalescer).
   Close MV-098-H (3 inch. Hi-pressure manifold 1" valve)
   Close MV-002-H (8 inch. suction header 1 inch valve)
   Close MV-009-H (8 inch. suction header 1 inch valve)

3. Remove all 1/2 inch purge feed and pump lines, remove vacuum pump.

4. Maintain a positive helium pressure on system (approx. 2 psi helium).


FROM LOW PRESSURE HELIUM MANIFOLD
TO HIGH PRESSURE HELIUM MANIFOLD
COMP. no.2 RED TAG
COMP. no.3 ORANGE TAG
COMP. no.4 YELLOW TAG
DO NOT EXIST IN 'B' BLDG.
'B' BLDG ONLY
TO CENTRAL (CHL)
C20A OIL MONITOR
C-2
C-1
AFTERCOOLER
S-2
W.P. 325 psi. max.
HEATER-HTR-1
OIL COOLER
MANIFOLD
OIL REMOVAL SKID ASSEMBLY
SEE NOTE 2
SEE NOTE 1
COALESCER no.1
COALESCER no.2
COALESCER no.3
CHARCOAL ADSORBER
MOLECULAR SIEVE
FINAL FILTER
FILTER-F4
FILTER-F5
OIL PUMP
LOAD
UNLOAD
FROM AC-1
TO AC-1
PER BLDG. 1 COMPR. ONLY
COMP. no.1 BROWN TAG
H₂O RETURN
H₂O SUPPLY
NOTES:
1) ALL FOUR OF THE COMPRESSOR SYSTEMS ARE FUNCTIONALLY IDENTICAL. INDIVIDUAL INSTRUMENT AND CONTROL IDENTITIES ARE TO BE TAGGED ACCORDING TO THE DESIGNATED "COLOR" OF EACH SYSTEM. (i.e. MV-003-H ON COMPRESSOR no.2 (RED TAG) SYSTEM, SHALL HAVE A RED COLORED TAG ENGRAVED "MV-003-H" PHYSICALLY ATTACHED TO THE VALVE)
2) ON THE F-Ø SYSTEM ONLY, A SET OF 2" ORIFICE FLANGES (FI-044-H) EXISTS IN THIS POSITION, EACH COMPRESSOR.
3. VALVE & INST NUMBERING SYSTEM
000 - 009 SUCTION, HELIUM
010 - 019 INTERSTAGE, HELIUM
020 - 029 DISCHARGE, HELIUM
030 - 039 LUBE OIL "BEFORE PUMP"
040 - 049 LUBE OIL "AFTER PUMP"
050 - 059 LUBE OIL "AFTER FILTER"
060 - 064 WATER HEADER SYSTEM
065 - 069 COMPRESSOR WATER
070 - 079 OIL SEPARATOR AFTER COOLER
080 - 089 OIL REMOVAL SKID
090 - 099 HIGH PRESSURE DISCHARGE AFTER OIL REMOVAL
SYSTEMS
-H-HELIUM
-O-OIL
-W-WATER
-ELECTRICAL or SENSING LINES
VALVES
MV-MANUALLY ACT.
PV-PNEUMATIC/PRESSURE ACT.
SV-SAFETY/RELIEF
DPCV-DIFF. PRESS. CONTROL
TCV-TEMP. CONTROL
CV-CHECK VALVE
EV-ELEC. ACT.
STR-STRAINER
INDICATORS & TRANSMITTERS
PI-PRESSURE IND.
FI-FLOW IND.
LI-LEVEL IND.
TI-TEMP. IND.
XI-POSITION IND.
EPNT-ELEC. PRESS. NON-IND. TRANSMITTER
ETNT-ELEC. TEMP. NON-IND. TRANSMITTER
EDPT-ELEC. DIFF. PRESS. NON-IND. TRANSMITTER
EPIC-ELEC. PRESS. IND. CONTROLLER
S/D-DENOTES SHUT DOWN
ELNT-ELEC. LEVEL NON-IND. TRANSMITTER
-LOCAL INST.
-REMOTE INST.
A RENUMBERED MV & INST.
B GENERAL REVISION
C CORRECTED CALL OUT NUMBER
D UPDATED VALVING LOCATION
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
TYPICAL COMPRESSOR BLDGS.
PIPING & INSTRUMENTATION FLOW DIAGRAM
9140-ME-129720
H